

NDIA Environment, Energy Security & Sustainability Symposium Presentation

12467 – Environmental Hazard Analysis – Task 210

Part of Upcoming Change to MIL-STD-882D



U.S. AIR FORCE

New Orleans, LA
May 2011

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

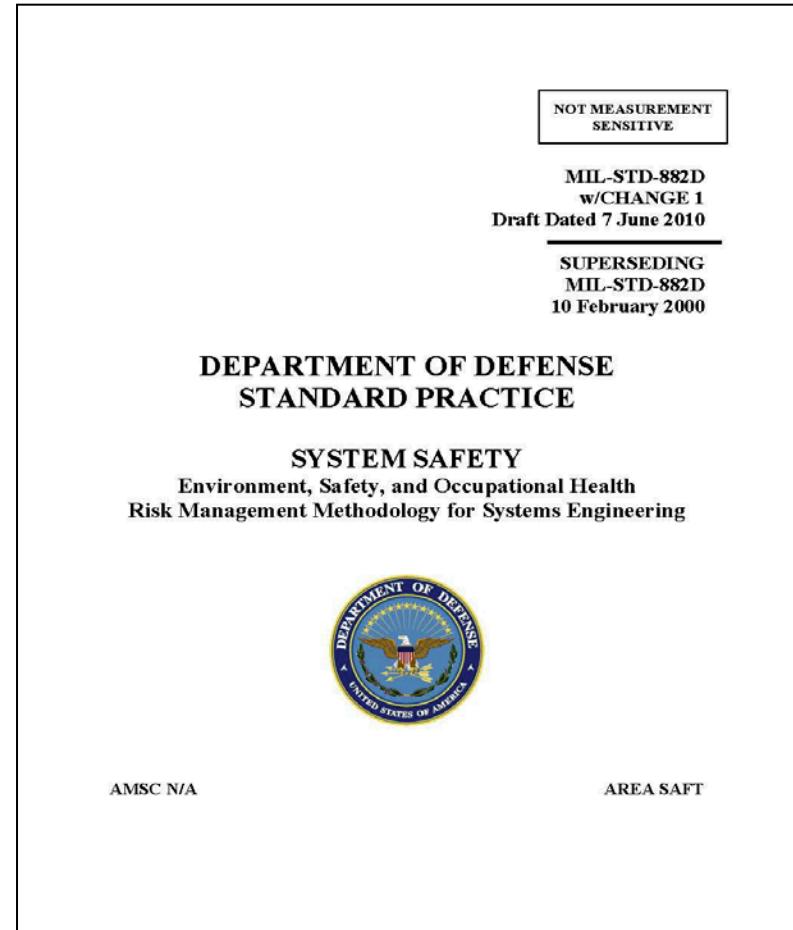
1. REPORT DATE MAY 2011	2. REPORT TYPE	3. DATES COVERED 00-00-2011 to 00-00-2011		
4. TITLE AND SUBTITLE Environmental Hazard Analysis -Task 210 Part of Upcoming Change to MIL-STD-882D			5a. CONTRACT NUMBER	5b. GRANT NUMBER
			5c. PROGRAM ELEMENT NUMBER	5d. PROJECT NUMBER
			5e. TASK NUMBER	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SAF/AQRE,1670 Air Force Pentagon,Washington,DC,20330-1670			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)	
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited				
13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA.				
14. ABSTRACT				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 25
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified		19a. NAME OF RESPONSIBLE PERSON

Bottom Line Up Front

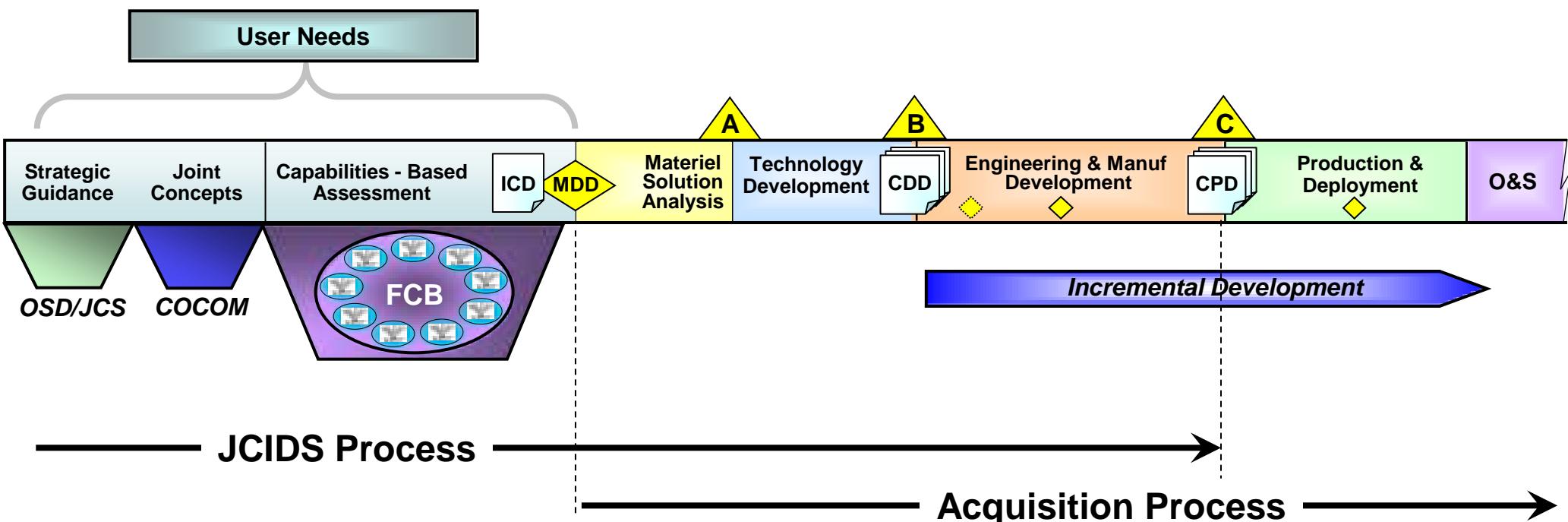
- ▶ MIL-STD 882 is the DoD Standard Practice for System Safety
- ▶ DoDI 5000.02 requires programs to use MIL-STD 882 system safety process to integrate ESOH considerations into Systems Engineering
- ▶ When issued, the new MIL-STD-882E will include task descriptions that can be placed on contract with the Original Equipment Manufacturer/Prime Contractor
- ▶ Task 210 describes how the contractor should use the MIL-STD 882E system safety risk management process for Environmental Hazard Analysis

Overview

- ▶ Introduction
- ▶ Background
 - MIL-STD 882 System Safety Process
 - Risk Assessment Matrix
 - Severity
 - Probability
- ▶ Task 210
 - Purpose and Structure
 - Example Hazard
- ▶ Risk Acceptance



Introduction - Defense Acquisition Management System



Introduction - DoD 5000.02 Acquisition ESOH Policy

- ▶ Use MIL-STD-882D, DoD Standard Practice for System Safety
 - In all developmental and sustaining engineering activities
 - To manage ESOH risks as part of the systems engineering process
 - Across the Acquisition Life cycle

ESOH refers to all individual, but interrelated, disciplines that encompass environment, safety, and occupational health

Background - MIL-STD-882D System Safety Process

1. Document the system safety approach
2. Identify hazards
3. Assess risk
4. Identify mitigation measures
5. Reduce risk
6. Verify risk reduction
7. Accept risk
8. Manage life-cycle risk



SYSTEM SAFETY ORDER OF PRECEDENCE

1. Eliminate hazards through design selection
2. Reduce risk through design alteration
3. Incorporate engineered features or devices
4. Provide warning devices
5. Develop procedures and training

Risk = Severity x Probability

Background - The Risk Assessment Matrix

		RISK ASSESSMENT MATRIX				
		Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)	
SEVERITY	PROBABILITY	Frequent (A)	High	High	High	Serious
		Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Medium	Medium	
Remote (D)	Serious	Medium	Medium	Low	Low	
Improbable (E)	Medium	Medium	Low	Low	Low	
Eliminated (F)	Eliminated					

DoD_MIL-STD-882_003

Background - ESOH Risk: Severity

SEVERITY CATEGORIES		
Severity Category	Severity Level	Environment, Safety, and Occupational Health Mishap Result Criteria
Catastrophic	1	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or loss exceeding \$10M.
Critical	2	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or loss exceeding \$1M but less than \$10M.
Marginal	3	Could result in one or more of the following: injury or occupational illness resulting in 10 or more lost work days, reversible moderate environmental impact, or loss exceeding \$100K but less than \$1M.
Negligible	4	Could result in one or more of the following: injury or illness resulting in less than 10 lost work days, minimal environmental impact, or loss less than \$100K.

Mishap. An unplanned event or series of events resulting in death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. For the purposes of this document, the term “mishap” includes negative environmental impacts from planned and unplanned events and accidents

Severity generally does not change unless an engineering design change is made

Background - ESOH Risk: Probability

PROBABILITY LEVELS			
Description	Level	Specific Individual Item ^{1,2}	Fleet or Inventory ²
Frequent	A	Likely to occur often in the life of an item; with a probability of occurrence greater than 10^{-1} in that life.	Continuously experienced.
Probable	B	Will occur several times in the life of an item; with a probability of occurrence less than 10^{-1} but greater than 10^{-2} in that life.	Will occur frequently.
Occasional	C	Likely to occur sometime in the life of an item; with a probability of occurrence less than 10^{-2} but greater than 10^{-3} in that life.	Will occur several times.
Remote	D	Unlikely, but possible to occur in the life of an item; with a probability of occurrence less than 10^{-3} but greater than 10^{-6} in that life.	Unlikely but can reasonably be expected to occur.
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced in the life of an item; with a probability of occurrence of less than 10^{-6} in that life.	Unlikely to occur, but possible
Eliminated ³	F	Incapable of occurrence in the life of an item. This category is used when potential hazards are identified and later eliminated.	Incapable of occurrence within the life of an item. This category is used when potential hazards are identified and later eliminated.

DoD_MIL-STD-882_002

Background - Revision of MIL-STD 882D Underway

- ▶ 882 already provides a methodology for risk management
- ▶ Revising MIL-STD-882D to be better suited for Managing Environmental Issues as part of the Systems Engineering Process
- ▶ Tasks are being added to address environmental considerations
 - Task 105 – Hazard Tracking System
 - Task 107 – Hazardous Materials Management Plan (HMMP)
 - Task 210 – Environmental Hazard Analysis

**Making MIL-STD 882 more “User Friendly”
for Environmental Professionals**

Task 210 – Purpose and Structure

- ▶ Purpose: Use System Safety process to identify environmental hazards, assess the associated risk, identify potential mitigation measures, implement chosen measures, reassess the risk, and obtain formal risk acceptance
- ▶ Task Structure:

210.1 Purpose

210.2 Task Description

- Using system safety process and risk matrix
- Identifying Environmental Requirements and Hazards
- Environmental analysis considerations
- Reporting Requirements

210.3 Details to be Specified

- Added by Government to Contract Scope to Bound the Analysis

Task 210 – Example Hazard

Example – Contaminated Wash Water from Nickel-Cadmium Plated Compressor Blades on T-56 Turboprop Engine									
Hazard	Description	Initial Severity	Initial Prob.	Initial Risk Category	Risk Mitigation	Target Severity	Target Prob.	Target Risk Category	Status
Contaminated wash water from Ni-Cd Plated Compressor Blades	Cadmium contaminated wash water effluent a NPS water pollutant in violation of State law (regulation of storm water discharge/NPDES) with potential for citations with fines, and civil and/or criminal liability for improper disposal of hazardous waste. Cadmium contaminated drinking water can result in acute and chronic health effects.	2	B	High	100 percent capture mandate for engine wash water requiring all DoD facilities to capture, contain, and properly treat or dispose of wash water effluent.	3	C	Med	This Program implemented this risk mitigation measure, verified its effectiveness in reducing the risk, and the PM accepted the FRC. However, the PM directed that during subsequent rework/upgrade of the T-56 turboprop engine an alternative risk mitigation measure must eliminate the hazard.
		2	B	High	Develop new compressor blades made of aluminum to replace the Ni-Cd plated blades. New blade design will eliminate the possibility of Cd leaching into the wash water effluent by eliminating the use of a hazardous material.	None	None	None	The Program verified that new Al blade design eliminated the hazard. Thus, the PM had no risk to accept.

Task 210 – Example: Hazard Description

Hazard	Description
Contaminated wash water from Ni-Cd Plated Compressor Blades	<p>Cadmium contaminated wash water effluent a NPS water pollutant in violation of State law (regulation of storm water discharge/NPDES) with potential for citations with fines, and civil and/or criminal liability for improper disposal of hazardous waste.</p> <p>Cadmium contaminated drinking water can result in acute and chronic health effects.</p>

Task 210 – Example: Initial Risk Assessment

Initial Severity	Initial Probability	Initial Risk Category
2	B	High

Task 210 – Example: What is the Severity?

SEVERITY CATEGORIES		
Severity Category	Severity Level	Environment, Safety, and Occupational Health Mishap Result Criteria
Catastrophic	1	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or loss exceeding \$10M.
Critical	2	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or loss exceeding \$1M but less than \$10M.
Marginal	3	Could result in one or more of the following: injury or occupational illness resulting in 10 or more lost work days, reversible moderate environmental impact, or loss exceeding \$100K but less than \$1M.
Negligible	4	Could result in one or more of the following: injury or illness resulting in less than 10 lost work days, minimal environmental impact, or loss less than \$100K.

DoD_MIL-STD-882_001

Task 210 – Example: What is the Probability?

PROBABILITY LEVELS			
Description	Level	Specific Individual Item ^{1,2}	Fleet or Inventory ²
Frequent	A	Likely to occur often in the life of an item; with a probability of occurrence greater than 10^{-1} in that life.	Continuously experienced.
Probable	B	Will occur several times in the life of an item; with a probability of occurrence less than 10^{-1} but greater than 10^{-2} in that life.	Will occur frequently.
Occasional	C	Likely to occur sometime in the life of an item; with a probability of occurrence less than 10^{-2} but greater than 10^{-3} in that life.	Will occur several times.
Remote	D	Unlikely, but possible to occur in the life of an item; with a probability of occurrence less than 10^{-3} but greater than 10^{-6} in that life.	Unlikely but can reasonably be expected to occur.
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced in the life of an item; with a probability of occurrence of less than 10^{-6} in that life.	Unlikely to occur, but possible
Eliminated ³	F	Incapable of occurrence in the life of an item. This category is used when potential hazards are identified and later eliminated.	Incapable of occurrence within the life of an item. This category is used when potential hazards are identified and later eliminated.

DoD_MIL-STD-882_002

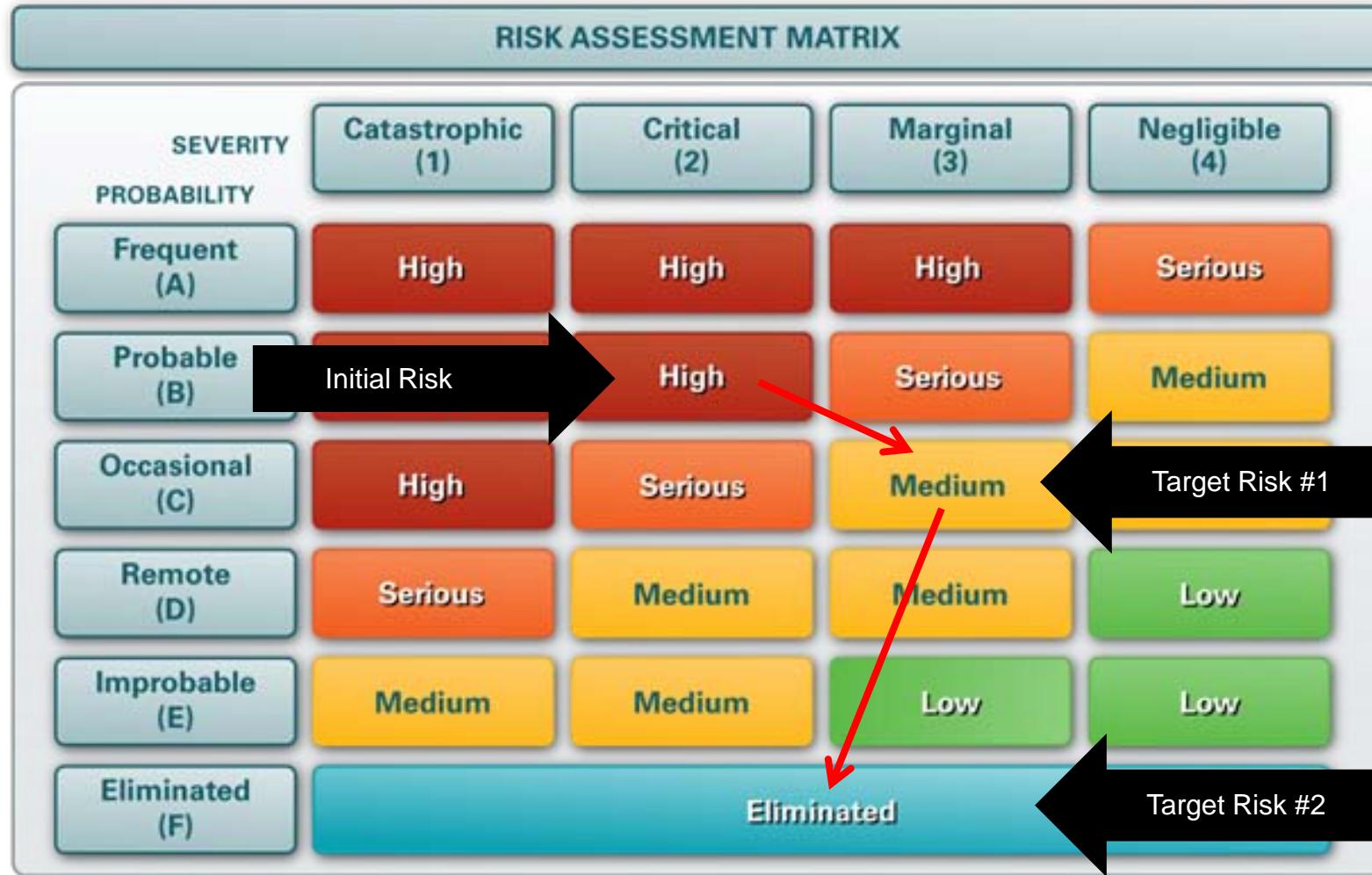
Task 210 – Example: Mitigations and Target Risk #1

Risk Mitigation	Target Severity	Target Probability	Target Risk Category	Status
100 percent capture mandated for engine wash water requiring all DoD facilities to capture, contain, and properly treat or dispose of wash water effluent.	3	C	Med	<p>This Program implemented this risk mitigation measure, verified its effectiveness in reducing the risk, and the PM accepted the Final Risk Category (FRC).</p> <p>However, the PM directed that during subsequent rework/upgrade of the T-56 turboprop engine an alternative risk mitigation measure must eliminate the hazard.</p>

Task 210 – Example: Mitigations and Target Risk #2 (Program Manager's Preference)

Risk Mitigation	Target Severity	Target Probability	Target Risk Category	Status
Develop new compressor blades made of aluminum to replace the Ni-Cd plated blades. New blade design will eliminate the possibility of Cd leaching into the wash water effluent by eliminating the use of a hazardous material.	None	F	Eliminated	The Program verified that new Al blade design eliminated the hazard. Thus, the PM had no risk to accept.

Task 210 – Example: Assessed Risk



Risk Acceptance

- ▶ ESOH Risk must be accepted prior to exposing people, equipment, or the environment to the hazard
 - All the mitigations must be verified effective and the associated risk is accepted (by appropriate authority)

Questions

- ▶ **Government Client**
 - **Sherman G. Forbes**
 - **SAF/AQRE**
 - **Acquisition ESOH Risk Management**
 - **Phone: 703-254-2480**
 - **E-mail: sherman.forbes@us.af.mil**

- ▶ **Presenter**
 - **William A Thacker Jr**
 - **Booz Allen Hamilton**
 - **Phone: (703) 412-7757**
 - **E-Mail: thacker_william@bah.com**



U.S. AIR FORCE

BACK UP CHARTS

Background

- ▶ System environmental risks could result in mission and operational constraints and compliance burdens for receiving installations, training ranges, and operational units
- ▶ Influencing design decisions is typically the most cost-effective means of effecting change to a system
 - It is important to consider potential environmental impacts during system design to eliminate the hazard vice manage them as operational constraints
 - Restricted times / intervals of operation
 - Restrictions on locations of operation
 - Negative impact of the environment
 - Fines and costs to manage/mitigate impacts

Background

- ▶ Early identification and resolution of environmental hazards through the systems engineering process
 - Bring environmentally-driven requirements to the table early in the process
 - Provides decision makers with a more complete and relevant picture of the potential risks associated with test, operation, sustainment, and disposal of the system
 - Advocate for funds for design changes or plan for operational mitigations
 - Helps mitigate the risk of unplanned technical, schedule, and cost impacts

DoD Standard Practice for System Safety

